

# Chapter 12

## CONCEPTS IN CONTINUOUS ASSURANCE

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### INTRODUCTION

Auditing technologies and methodologies are continually changing to catch up with business data processing methods. For instance, the introduction of computers in business forced the creation of Electronic Data Processing (EDP) auditing. Databases and distributed computing substantially changed audit risks and forced the utilization of essential new audit tools. The advent of the Internet, the consequent internetworking<sup>1</sup> of applications, and the progressive electronization of many corporate processes have accelerated the trend and demand for new, more timely assurance processes. Kogan et al. (1999) have described a research program needed for additional understanding of continuous online audit. This chapter aims to introduce a series of research issues for additional examination that may lead to an improved conceptualization of modern assurance and related processes.

In the future, the entire concept of audit will change to a loose set of assurance services, some of which will be statutory in nature. Figure 12-1 describes an assurance centric view of corporate monitoring processes. Corporate IT (legacy, middleware, and Internet systems) provides the online monitoring structure at the same time that it provides for a series of real-time administrative processes (e.g., cash management or receivables management). High-level corporate metrics, KPIs (key performance indicators), are extracted from the monitoring infrastructure and provide for corporate scorecards and other processes. Many management processes progressively rely on this infrastructure. One of these processes is the evolving field of continuous assurance.

Four main issues distinguish assurance processes from other management support functions: data structures, independent review, the nature of analytics, and the nature of alarms. The data structures tend to focus on cross-process metrics and time-series evaluation data. A particular process is managed independently under the control of third parties. Its analytics focus is on cross-process integrity

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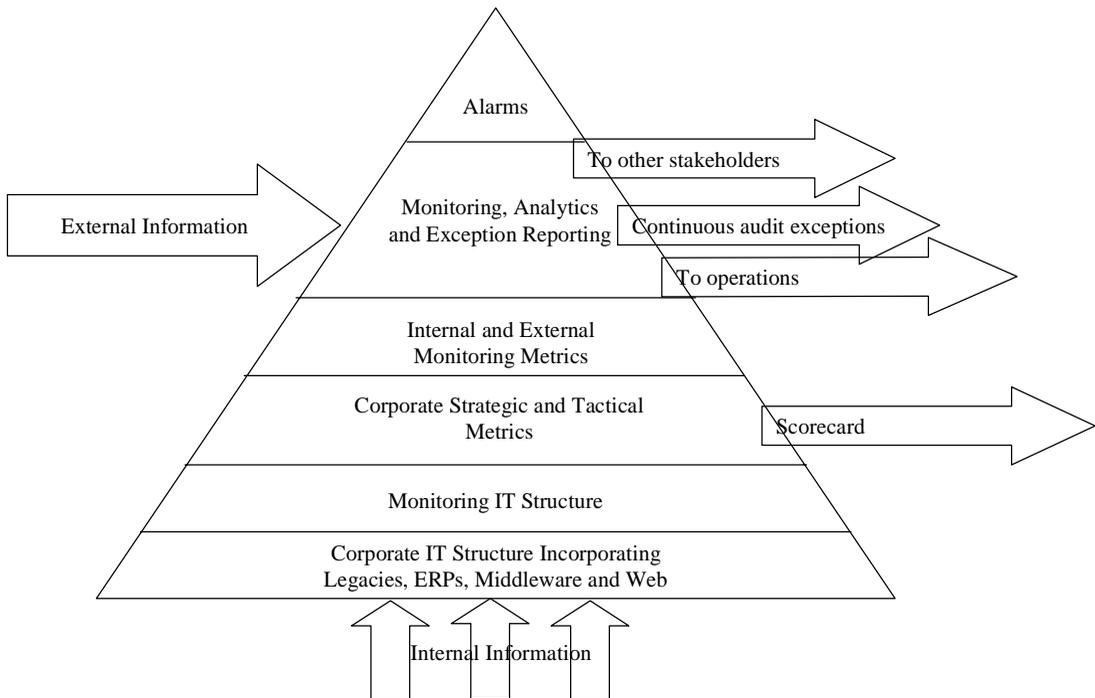
<sup>1</sup> Faster application cycles, the outsourcing of many parts of the value-addition processes, and the interconnection of applications create complexities and response requirements that did not exist in the past. E-Schwabe for example, continuously monitors all trades and filters some for tighter scrutiny by internal auditors.

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I am very grateful for the many comments I received from my colleagues Alexander Kogan and Michael Alles of Rutgers University, Ted Mock of the University of Southern California, Vicky Arnold and Steve Sutton of the University of Connecticut, and the anonymous reviewers.

While the author is a member of both the SysTrust and Continuous SysTrust committees of the AICPA/CICA, this paper does not represent positions of those committees or of the AICPA or CICA. The paper is meant to motivate discussions and advance concepts in academia and practice.

**FIGURE 12-1**  
**The IT Structure, Monitoring Overlay, and By-Product Assurance**



and internal control probity. Its alarms are independently delivered to auditors (and other parties) and are defined, reviewed, and tested by these assurance professionals.

Continuous assurance (CA) is therefore an aggregate of objectively provided assurance services, derived from continuous online management information structures—the objective of which is to improve the accuracy of corporate information processes. These same services may also provide different forms of attestation including point-in-time, evergreen, and continuous.

While the concepts around continuous audit have been advocated since the late eighties, only one well-documented application (Vasarhelyi and Halper 1991) has appeared in the major journals. More recently several Big 5 efforts<sup>2</sup> have been presented in academic and professional conferences. The current flurry of professional interest, represented by AICPA/CICA committees will inevitably create additional momentum for accounting statutes as well as for some degree of interdisciplinary CA activity.

### Technology Motivators

While online computing technology emerged in the late sixties, the current technological environment will facilitate a more powerful and different attestation process. These technologies encompass the different aspects of the internetworking environment, the emergence of Enterprise Resource Planning Systems (ERPSs) as key factors in corporate computing, and the advent of a layer of internetworking-based commerce processes. Furthermore, a series of audit risks has emerged that cannot be properly addressed by traditional audit methodologies. These risks involve many

<sup>2</sup> For example, KPMG presented its Fund Radar application at the Continuous Audit Symposium in January 1998 at Rutgers University.

issues including: (1) paperless transactions that are completed rapidly without human review for reasonableness, (2) progressive omni-presence of e-business and processes that are automated, (3) widespread existence of viruses, (4) internetworked processes that serve more than one organization, (5) extensive use of outsourcing, (6) denial of service attacks over the Internet, and (7) businesses that are essentially faceless and multinational.

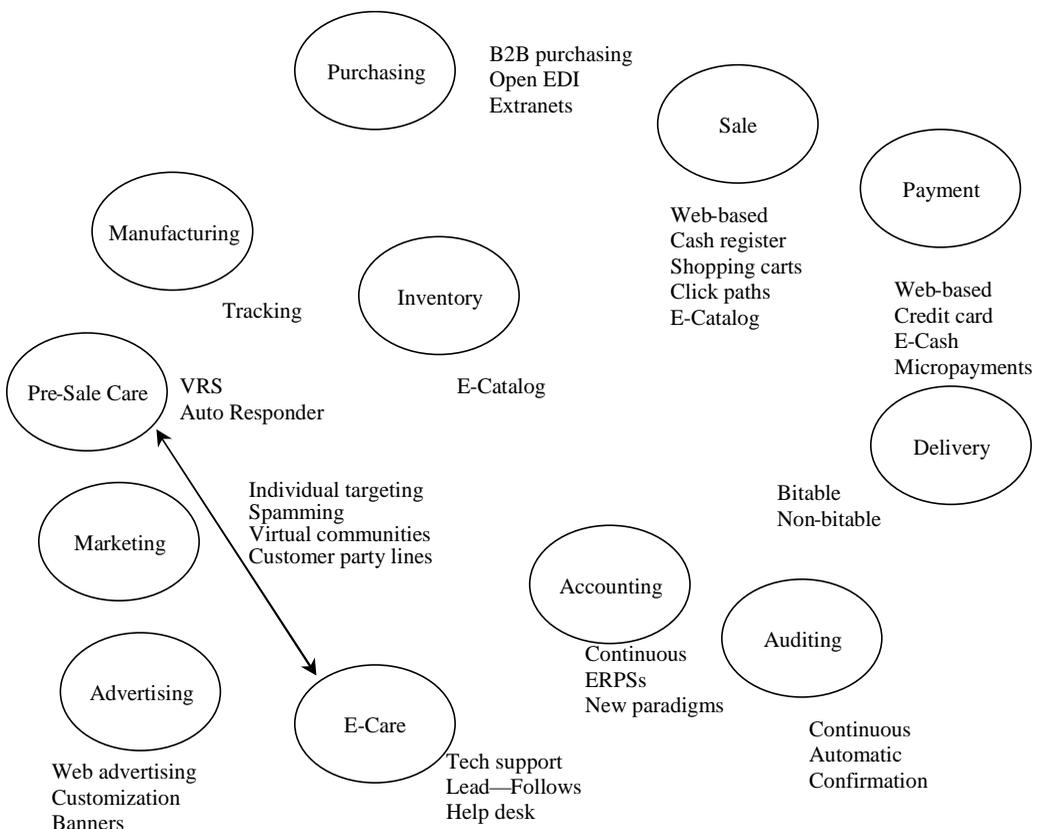
**Business Environment Motivators**

The above technological factors and threats are permeated into an emerging business environment with two main types of businesses (Hoffman, Novak, and Chatterjee 1998): native Internet businesses (Bambury 1998) and traditional businesses that are undergoing a process of electronization (Vasarhelyi and Greenstein 2001). An unprecedented surge of productivity is being observed in both native Internet and electronizing organizations. Native Internet businesses are creating opportunities for dis-intermediation, re-intermediation, and new business concepts. Traditional businesses are focusing on electronizing key processes and creating new web presences. Figure 12-2 describes a wide view of corporate processes and some of the facilitating internetworking tools.

Each of these processes is undergoing fundamental re-thinking with progressive change based on strategic priorities and perceived opportunities. Organizations with mainly bitable products<sup>3</sup>

<sup>3</sup> These include software, information, banking, insurance, and brokerage.

**FIGURE 12-2**  
**The Electronization of Business**



have led the way. Furthermore, the next issue is one of e-commoditization. An e-commodity is a nonbitable good that does not need to be seen, touched, tried, squeezed, or tasted by the buyer to be acquired. Organizations producing bitable goods and/or e-commodities (component producers, producers, intermediaries, and retailers) present the highest potential for electronization and will lead the e-commerce bandwagon. These organizations also offer very high profiles of risk<sup>4</sup> in audit processes as well the need for deeper and unorthodox thinking about their assurance needs.

### **THE LITERATURE**

The idea of continuous auditing has evolved over the last decade. Since the early seventies when the computerization of accounting operations induced the development of electronic data processing, EDP auditing emerged as a new auditing field leading to a significant increase in audit efficiency. The evolution of online/time-sharing computer technology, with its basis in the airline reservation systems of the early seventies provided a new paradigm on electronic data processing. This paradigm has evolved to intensively databased corporate systems in the eighties and in the internetworking environment arising in the late nineties (Cash et al 1977; Hansen and Hill 1989; Boritz 1995; Warren et al 1996).

The advent and proliferation of corporate-wide networks is enabling progressive integration of worldwide manufacturing, inventory keeping, and financial management as well as increasingly informative forms of corporate reporting. Operational requirements for the global organization now allow for worldwide deployment of the production cycle. The world car concept by Ford allows for manufacturing in different countries and delivery of differently configured models (e.g., left-right steering wheel, narrower models for the narrower streets of Europe). On the other hand this creates great coordination and communication needs across these units and creates increased country and supply chain risk.

Widespread availability of computer networking makes it possible to dramatically increase the frequency of periodic audits by redesigning the auditing architecture around online auditing. For example, if internal (or external) auditors annually perform reconciliations in an audit, these procedures can be “wired into” software and performed every day or business cycle. If out-of-balance conditions arise, alarms can be created.

The spectacular growth of the Internet has created a new set of opportunities and challenges confronting corporate management and reporting. These developments have set the stage for continuous online reporting. The exponential growth of online retailing, online securities trading, and online procurement systems emphasizes the need for continuous online monitoring of transactions (see Elliott 1995; Debreceny and Gray 1996; Kogan et al. 1996). An evolutionary set of academic efforts has finally been followed by a series of institutional committees and reports that bring attention to the field.

### **Academic Research**

Continuous process auditing research started over a decade ago (Groomer and Murthy 1989; Vasarhelyi and Halper 1991) following the early developments in EDP auditing. Cash et al. (1977) developed the TICOM system that attempted to formalize the analysis of corporate internal control systems. Groomer and Murthy (1989) proposed embedded audit modules to capture information on a continuous basis. Embedded audit modules represent a methodology used for data capture and evaluation (part of the toolset of the CA). Embedded audit modules continue to be an essential part of the Continuous Assurance Architecture and will be progressively replaced/complemented by intelligent agents performing limited audit functions. Early research efforts (Bailey et al. 1985; Gal and McCarthy 1985) designed to formalize the representation of internal controls can be linked to

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<sup>4</sup> Internet businesses have many increased risk factors such as paperless processes, rapid turnover, danger of intrusion and denial of service, etc.

the concepts around embedded audit modules. This formal representation allows adaptive analysis of transactions based on some normative progressive review of the perceived risk of existing internal control structures.

### **Institutional Efforts**

The accounting profession, as represented by the American Institute of Certified Public Accountants (AICPA) and the Canadian Institute of Chartered Accountants (CICA) recently realized that practice should expand beyond the traditional annual audits of financial statements to provide broader types of assurance services. The Elliot Committee<sup>5</sup> argued that significant societal, economic, and technological developments are generating substantial changes in the accounting profession and that major opportunities exist for accountants. The Committee proposed the development of new types of assurance services, including Information Systems Reliability and Electronic Commerce assurance services,<sup>6</sup> which led to WebTrust and SysTrust services. Describing systems reliability, the committee stated:

The CPA monitors the functioning of the organization's systems to ensure that they provide reliable data. This service involves either *regular* or, ultimately, *continuous* oversight. It presumes some level of direct involvement in computer operations by the CPA. He or she would either (1) embed some level of monitoring or control in the client's system or (2) direct regular inquiries into client processing systems/databases. This service, while *initially* aimed at *internal* users, would have its greatest appeal to external users who want to rely on entity data delivered at interim dates and, ultimately, continuously.<sup>7</sup> (AICPA 1997) (emphasis added)

With the issuance of SysTrust 1.0, and subsequently version 2.0, the AICPA/CICA produced an attestation service to issue an opinion on the reliability of computer systems along four principles: (1) security, (2) integrity, (3) availability, and (4) maintainability.

The CICA, and later the AICPA, established a committee chaired by Richard Wood to examine "continuous auditing" (CICA/AICPA 1999). This report discussed the nature, purpose, scope, and fundamentals of a continuous audit. The report provided several examples of potential continuous auditing services. These include: (1) continuous assurance regarding the authenticity, integrity, and nonrepudiation of electronic commerce transactions in connection with the AICPA/CICA WebTrust Seal assurance service; (2) continuous assurance on controls over electronic commerce systems, over compliance with debt covenants, and over the security of web sites containing reports on significant decision-making information; (3) continuous assurance on specific financial information (e.g., inventory levels), on mutual fund unit values, including assurance on effective controls over the unit-holder system; (4) continuous audits of financial statements; and (5) continuous assurance regarding marketing information (e.g., sales of a new product by a software vendor), regarding media ratings, hits on the web site, and banner downloads. These are services that have not been traditionally offered by accountants and require new standards, skills, and methodologies to be added to the accountant's toolset.

In April 2000, the AICPA and CICA set up a new committee to follow up on the initial concept of systems reliability, where the SysTrust initiative would be the intermediate step to a continuous assurance process. This committee will be considering many of the issues being advanced in this paper and is particularly aimed at understanding the impact of continuous assurance on auditing standards. Once the committee prepares its report, it will most likely be transferred to a task force of the assurance area to develop a product.

<sup>5</sup> <http://www.aicpa.org/assurance>

<sup>6</sup> Further developments in Electronic Commerce assurance have led to the announcement of CPA WebTrust (see AICPA 1998; also see Greenstein 1998; Srivastava and Mock 2000).

<sup>7</sup> Adapted from the ASEC report (see AICPA 1997, the corresponding section of the web site).

### **Some Experiences in Continuous Online Auditing**

Vasarhelyi and Halper (1991) focused on the “Continuous Process Auditing System” (CPAS) designed to deal with the problems of auditing large paperless database systems. CPAS developed a methodology for continuous auditing and described its implementation at AT&T. The CPAS methodology was designed to measure and monitor large systems, drawing key metrics and analytics into a workstation environment. The data were displayed interactively, providing auditors with a work platform to examine extracted data and prepare auditing reports. CPAS monitored key operational analytics, compared these with standards, and rang alarms when necessary.<sup>8</sup> The CPAS effort entailed the continuous audit and monitoring of AT&T billings that were processed at four large data centers in different parts of the nation.

Fund Radar is used at KPMG to audit mutual funds. The principles of operation are similar to the ones in CPAS with industry averages drawn from an online source and serving as benchmarks. The mutual funds industry is particularly suitable for continuous online audit (COA) as three vendors supply software to most funds in the industry. Consequently, three software implementations of Fund Radar with similar analytics and different data provisioning could conceivably be sufficient for the majority of the firms in the industry.

The accounting firm of Ernst & Young (E&Y) is using online auditing and monitoring in several applications. In particular, they use online monitoring of a client’s network for security purposes and are developing a CPAS-like application using HMOs as the application domain. HMOs, as in the mutual fund industry example above, have one software package with substantial market share. Consequently, utilizing a single software package makes it easier for E&Y to capitalize on a COA investment and deploy it in other HMO clients that use the same software.

Academic research, technological evolution, institutional committees, and the experiences of major corporations and professional service firms are progressively leading to a new model of auditing. The next section proposes a new, normative assurance model.

### **A DRAMATIC CHANGE IN THE AUDIT MODEL**

The evolution of audit thinking, the availability of new technologies, the evolution of business toward different forms of electronization, and the progressive aging of the audit product requires new thinking in the auditing arena. Kogan et al. (1999) have proposed a wide program of research for continuous online auditing. Their research priorities were divided into three major areas: (1) architectural issues relating to COA, (2) factors affecting COA, and (3) effects/consequences of COA. This section enhances this frame by proposing an organizational context (stakeholders), assurance methodology (new analytics) and conceptual clarification (independence, materiality, assurance) to the field. The ensuing propositions articulate a series of normative and conceptual propositions toward auditing.

#### **Proposition 1: The Continuous Assurance Model has Many Clients**

While the traditional audit model has stockholders as the beneficiaries, the clients are actually the auditees who contract with the auditors, pay the bills, and ultimately deal with the auditors. This client/auditor relationship is probably a larger source of lack of independence than many of the issues extensively discussed in the literature and currently raised by the SEC.<sup>9</sup> A revised audit model may entail any of the following: (1) investors paying a fee to see an “evergreen” audit report; (2) banks paying for continuous covenant monitoring; (3) banks charging lower mortgage/loan fees for continuously monitored clients; (4) insurance companies paying for certain assurances regarding respect for the law and environment; (5) insurance firms charging lower fees for continuous

<sup>8</sup> To the best of our knowledge, CPAS (see also Vasarhelyi et al. 1991; Halper et al. 1992) is the only operational CA system in actual use whose architecture is described in detail in scholarly publications.

<sup>9</sup> Such as auditors rendering audit and management consulting services.

monitoring of relevant variables; and (6) customers and creditors paying for continuous assurance of the financial health of the organization.

This new audit approach will take the more modern view of the enterprise where a larger community of stakeholders actually has some economic interest in the enterprise. Many of these groups actually have a larger stake in the firm than stockholders. These stakeholders include clients,<sup>10</sup> suppliers, banks, insurance companies, local government, federal government, and the community. This view also argues for a substantially enhanced set of financial reports that have continuity (continuous and timely reporting) as well as a wider set of variables.

On the client side of the new audit, continuous assurance requires more direct relationships (e.g., reporting specifications and direct payments) between auditors and stakeholders, requires better comprehension by the auditors of stakeholders' needs, and requires some relief from regulation FD<sup>11</sup> to provide narrow assurance to a limited set of entities (stakeholders).

How the current audit model can evolve toward the multiclient model without dramatic change in entities and processes is unclear at this point. While several of the other principles are evolutionary, the formation of a stakeholder committee to (1) work with the audit committee, board of directors, and management; (2) contract with auditors; and (3) request a set of layered specific assurances is revolutionary; strong, unnatural changes must occur.

### **Proposition 2: The Continuous Assurance Model Has Different Independence Considerations**

The advent of continuous monitoring systems brings the assurer into a semi-supervisory role, as he/she will be constantly associated with the performance of the business and evaluating its performance. Auditors, in the traditional role, have only considered performance in evaluating going-concern issues. With strategic auditing and its performance-related features, assurers will clearly be more threatening to managers and executives, as well as more involved in reviewing company operations. This close concern and coupling to company operations also can be viewed as a potential reduction of assurer independence. Furthermore, the role of the assurer in providing advice regarding the setup of a monitoring system or even consulting on the matter of such a system can also be viewed as a reduction of independence. Traditionally regulators have been concerned with the overlap of consulting and assurance roles, which would be a similar type of situation.

On the other hand, with the ultimate objective being maintenance of objectivity and managed independence, other contravening factors may exist. CA teams can be specialized and have analytics defined by independent third parties, as the clientele for continuous assurance may be much wider than the auditee itself. The traditional form of lack of independence may not exist because the client may not even be the auditee—it may be some other stakeholder. If stakeholders are the clients, then many independence considerations of today disappear, and the third-party assurer is more objective.

### **Proposition 3: The Continuous Assurance Model Has a Different Justification**

The traditional auditing model was justified by the need for third-party assurance on the moral hazard gap between owners and managers. In that situation, a manager's actions are not observable by the principals (stockholders) and a third, independent party must attest to the fairness of the financial results. As tertiary observation is a difficult, imprecise, and expensive process the concept of materiality (relative allowable error) was created. *Ex post* assurance, provided in conjunction with reporting standards, had an important role in traditional corporate economics providing comparability and a common language for reporting. In response to *ex post* assurance becoming progressively less reassuring, the profession developed requirements for interim reporting and

<sup>10</sup> In particular those with large, and long-term supply contracts, substantive affiliates, outsourcees, etc.

<sup>11</sup> Recently, the SEC issued regulation FD in an attempt to regulate the timing and nature of private disclosures made by firms to financial analysts. The SEC's concern was fairness with stockholders not giving "inside" information to analysts.

attestation (review of quarterly statements and rules for events at year-end and before the audit report). This attenuated the effects of the acceleration of business pace and satisfied the need for more frequent information provisioning.

Technology can provide a new toolset to measure performance and provide assurance, which may reverse the progressive decrease in relevance of accounting measures and their attestation. Now auditors can implement an independent superstructure of measurements linking related processes and rely on the measures through a toolset of automated links among independent entities. For example, intelligent software agents can replace confirmation of receivables or payables. Agents could render continuous queries into third-party systems, obtain confirmation of balances and transactions, and reconcile cutoff and float differences. These second harmonic measurements are more sensitive to fluctuations and show discrepancies with much higher sensitivity.

Ultimately, the analytic superstructure of relationships, the linkage of financial to logistic and other processes (e.g., human resources, intellectual property, legal), the linkage to strategic monitoring, and the close scrutiny of each transaction through tertiary signaling will create a double-edged process. On one side it will provide a more timely assurance function; on the other, it will improve the quality of corporate operations by decreasing the number of errors and discrepancies. The value-added of the assurance service will entail improved accuracy of transactions, improved directionality of managers' actions, and assurance of management actions by a third party, independent assurer.

#### **Proposition 4: The Continuous Assurance Model Is an Element of Strategic Monitoring**

Both KPMG and Arthur Anderson have adopted new audit methodologies aimed at examining corporate strategies and relating these to actual operational factors. This type of approach can only work with an infrastructure of measurement and review that provides metrics of strategic and tactical progress throughout the year. This structure will be similar to the one necessary for obtaining some form of continuous assurance.

Professional firms aim at improving the value-added of their efforts by forcing organizations to define and quantify strategic objectives and tactical approaches. This quantification is linked to company KPIs that are actual indicators of the company performance along a certain set of measures. If strategic or tactical objectives are not met, or only partially met, then indications of this fact can be transmitted to management. This position could place the firms as the trusted measurers of corporate performance. Unfortunately, professional firms presently do not have the measurement infrastructures in place to perform these value-added services.

#### **Proposition 5: The Continuous Assurance Model Will Turn the Audit Process into Audit by Exception**

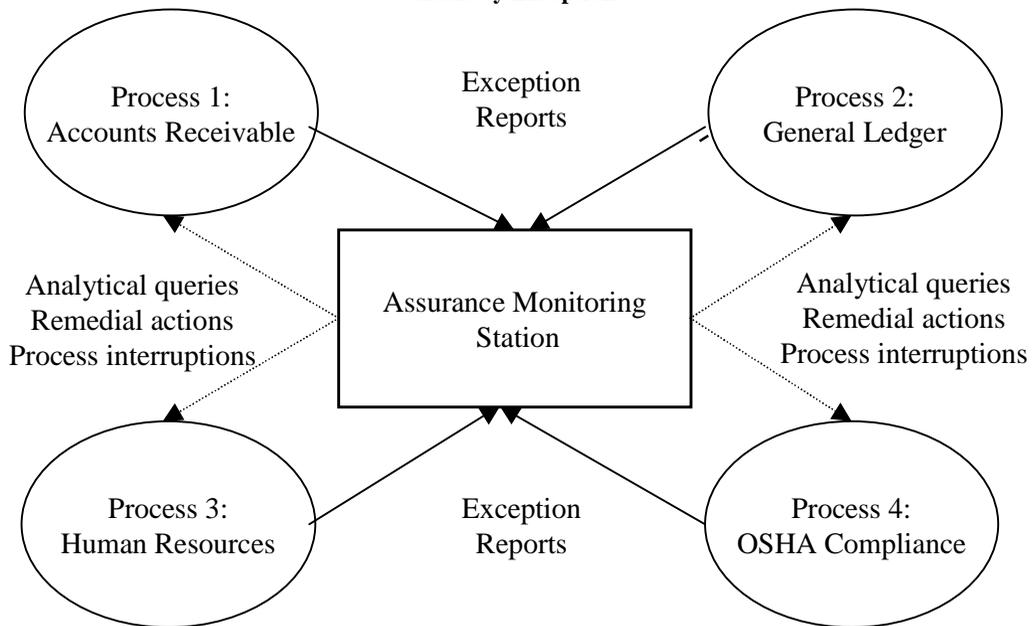
The extant audit process is typically performed with interim work covering internal control evaluation and year-end compliance testing that focuses on balance sheet objectives and substantive testing. Over the past few years, the focus of audit has further changed toward internal control evaluation; and this can be viewed as a type of "audit by exception." The future audit will add to the structural review of the organization and provide compliance testing of an entire dimension of continuous monitoring, exception reporting, and system change detection. Although the testing will be performed at one moment in time, it can be repeated over and over to provide continuous monitoring of events.

In the new audit model, much of the work will be performed at system design and pre-implementation.<sup>12</sup> Subsequently, assurers will continuously monitor several systems waiting for exceptions to occur prior to the assurers scheduled review or intervention. Figure 12-3 describes

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<sup>12</sup> Continuous audit typically entails substantial structural set-up efforts and much less of episodic work. Auditing firms will set up the measurement infrastructure and analytics at the time of the first engagement, update this setup when the system changes, and not perform yearly testing but rather work on found exceptions.

**FIGURE 12-3**  
**Audit by Exception**



this view of the world. While it illustrates the monitoring of four processes, other processes such as inventory management, manufacturing, and logistic may also be monitored contingent on the type of industry or product being offered. The selection of processes to be monitored relates directly to the economics of the process and the advantages that can be obtained (e.g., risk management and discrepancy reductions).

Companies will operate on a continuous digital collection and processing basis and be continuously monitored and compared with models of corporate/process behavior. Adaptive monitoring analytics will serve as a basis for comparing discrepancies between actual and standard performance. Significant or e-material<sup>13</sup> discrepancies are reported to assurers and management at the time of the event; regular audits are not performed. Auditors will intervene when these discrepancies generate alarms, will diagnose the nature of the discrepancies, and will react accordingly along two potential actions: (1) refine the model so as not to call an alarm in a false-alarm case by impounding expanded diagnostics, and (2) issue alarm reports of different levels of intensity (seriousness). Monitoring processes will be active continuously and controlled by a central facility (the assurance control center), which will supervise many processes, divisions, and cooperating organizations. Assurance reviews will be activated by alarms and problem diagnostics.

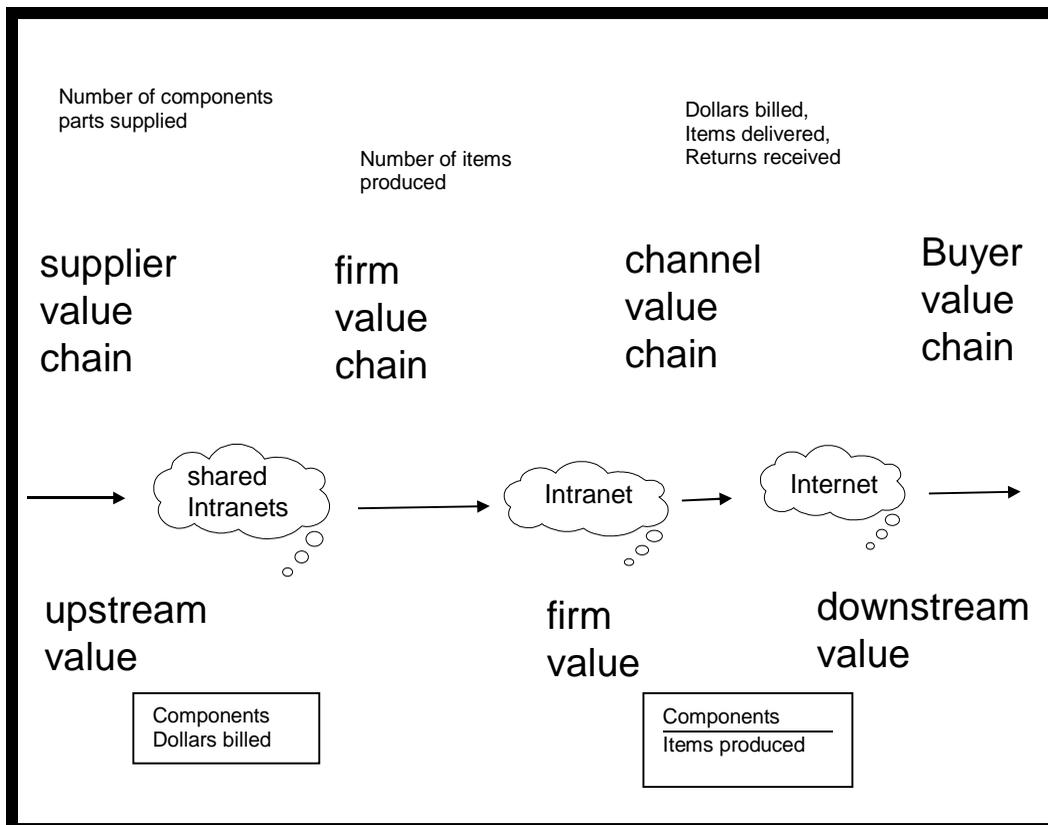
**Proposition 6: A New Set of Analytics Will Guide Strategic Monitoring**

Traditional analytical review typically encompasses both time-series and cross-sectional evaluation of business results. Auditors will typically calculate critical financial ratios, follow these on a month-to-month basis, and compare them with industry standards or company analogous models for detection of discrepancies and distortion of relationships.

Figure 12-4 illustrates a set of wider analytics, not only of financial nature, that will monitor process equilibrium and continuity. In this model, the weight of raw materials (not in the picture)

<sup>13</sup> Material in an e-commerce environment.

**FIGURE 12-4**  
**Expanded Analytics**



can be linked to hours worked by temporary workers, miles traveled by related company trucks, warranty calls made by customers, number of transactions recorded, the value in dollars of these transactions, amounts of dollars collected, the deployment of these dollars in checking accounts, etc. Overall there are many different measures that have logical relationships and these can be modeled and compared to obtain high-level analytics.

These wide measures along the supply chain provide much broader assurance on the equilibrium and proper development of operations. Fictitious billing, anomalous floats, defective shipments, etc., are more readily detectable and provide invaluable incremental information in the support of the corporate value chain. Organizations (and assurers) will focus on a much wider set of analytics of two types: (1) across the value chain analytics that relate standards of different processes, and (2) time-series analytics that watch a process over time.<sup>14</sup> For example, advertising expenditures incurred in a specific geographic area should be related to (after a lag) sales in that area. These sales will have progressive time erosion and some cross-geographical effect. Auditors should understand the time delay and progressive smoothing effects and expect some attenuation and across geography effects. Furthermore with the development of relationship standards many

<sup>14</sup> Traditional auditors have not been as experienced at examining and monitoring time-series data as other fields (e.g., weather forecasters). Consequently the experiential component is still absent and will be developed progressively.

units of measurement will exist. At the manufacture site there will be units produced, dollar value of the production, hours worked, etc., each of which will allow for the development of high-level monitoring analytics.

**Proposition 7: The Continuous Assurance Model Covers a Wider Set of Quantitative and Qualitative Nonfinancial Data**

Notable in the above item is the adoption of a wide range of variables including nonfinancial measures with the potential to expand substantially the scope and value of assessor's services. Some audit clients receiving these expanded services will gather information and monitoring data for additional activities or simply the management of risk.

Traditional information structures are progressively being expanded with the provisioning of qualitative, external information. This additional information has value to both corporate management and assurance services. Vasarhelyi and Peng (1999) propose the usage of qualitative news items, and indices derived from this information, as audit attention-getting tools. Typically, top management will need unstructured external information and highly aggregated internal information, while lower supervision will tend to use structured, fine internal information to meet day-to-day operational needs. Since continuous assurance will be a component of strategic monitoring, information structures similar to the ones required by top management will be needed. Table 12-1 describes some of this expanded set of variables.

**Proposition 8: The Continuous Assurance Model Has Alternate Materiality Considerations**

While materiality is currently defined through a group of guiding principles rather than an exact formula, the materiality threshold is typically a value that is considered basic. Materiality is reduced to various components that are allocated and reconciled along corporate account risks. The materiality principle relates to relative error and the cost of assuring to an allowable error—the smaller the allowable error, the higher the cost of the audit. Historical materiality thresholds relate to several concepts that may be less relevant as information-processing technology evolves and the new models of the firm develop. Changes in information technology change the cost<sup>15</sup> of data collection, verification, and authentication, which consequently change the optimal threshold of materiality. The threshold of materiality has been conceptually related to individual investor decision making. Any data inaccurate enough to lead an investor to a different erroneous decision on a stock (buy, sell, hold) is deemed as materially incorrect. The modern model of the firm requires bringing in the needs and decisions of other corporate stakeholders that often have bigger stakes in the firm.

The new model of acceptable measurement error (materiality) has to do with the trade-offs of spending resources and obtaining improved operational accuracy of corporate systems. Quality considerations will determine the effort needed to determine accuracy, timeliness, and assurance. Thresholds of error will depend on the new justification of the audit discussed in Proposition 3. Assurance is a value-added data improvement service, and the threshold of acuity will depend on the trade-offs between the benefits and costs of the particular process in question. New technology and continuous monitoring/assurance will substantively reduce materiality (allowable error) thresholds and will lead to audits being justified by improved error detection and decreased losses due to data errors.

**Proposition 9: The Continuous Assurance Opinion Has Some Futurity Implied in It**

Ultimately, many forms of continuous assurance are likely to emerge. These other forms of assurance will join the traditional audit opinion (albeit in some alternate format) to create the

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<sup>15</sup> Companies may now automatically confirm bank balances and other items with third parties, may create schemata in their databases to have ready-made audit reports, and may reconcile across processes on a continuous basis reducing considerably the amount of audit work.

overall assurance combination. This assurance combination will be provided by an independent third party who will monitor operations, review high-level analytics and report significant (e-material) discrepancies that arise.

While the traditional audit, in particular internal control evaluation and SysTrust-type reporting, have some implicit futurity impounded, continuous assurance brings this concept to a much higher and explicit level. However, analogous to a defined procedures engagement, the contractual terms of the engagement (implicit or explicit) will limit liability and clearly specify the users, the purpose of the “evergreen” report, the conditions of variance reporting, and the implicit conditions of assurance. Assertions as follow can be envisaged:

We have examined the reliability and financial reports of ABC Corporation and have been engaged on a continuous assurance engagement for the fiscal year of 2xxx. We will monitor the organization’s operations and strategic accomplishments using a wide set of analytics as described in <http://www.ca.com/analytics> and other analytics we deem appropriate and will report on an audit by exception basis when more than xx % variance is found in operational and strategic standards or when we deem it appropriate. This exception report will be issued to all customers registered (paying) at <http://www.ca.com/analytics/customers>.

or:

We have been engaged on a continuous assurance engagement for the fiscal year of 2xxx for the purpose of covenant monitoring. We will monitor the organization’s covenants as described in our agreement with bank XYZ using a specified set of covenant figures and wide set of analytics as described in <http://www.ca.com/analytics> and other analytics we deem appropriate and will report on an audit by exception basis when more covenants are violated by more than xx% for a day or when we deem it appropriate. This exception report will be issued to bank XYZ immediately when the variance day is completed and to all customers registered (paying) at <http://www.ca.com/analytics/customers>.

These disclosures raise a series of question that represent changes to the paradigm that must eventually be considered by the business measurement and assurance community. Is it allowable<sup>16</sup> to have selective disclosure of measured events that are available only to the entities that pay for them or have the need to know? However, operational reasons make selective disclosure to banks, insurance companies, clients, and suppliers a must in modern business. It is a myth to assume that the main source of disclosure to stakeholders is the official financial statements.

Is there a place for several different forms of audit opinion in the domain of corporate measurement and operations? While this has not been clearly specified in the standards, SAS No. 70<sup>17</sup> audit opinions (AICPA 2000), SysTrust opinions (AICPA/CICA 2001), and WebTrust seals (AICPA 1998) can coexist and prosper. Likely many other forms of assurance will emerge and be used, often still using the same infrastructure of measurement. While these nine propositions emphasized assurance, they are closed linked with the measurement and reporting process that also must suffer a dramatic new model, starting with some form of continuous reporting.

### **CONTINUOUS REPORTING ISSUES**

Continuous reporting and assurance are closely linked. There is no continuous assurance without monitoring and intense measuring. Most modern organizations keep many accounts online in real-time. These measurements and related business processes such as inventory measurement

<sup>16</sup> The SEC has recently curbed corporate practices of limited disclosures, say to analysts, through its rule FD.

<sup>17</sup> Professional firms now offer a gamut of services under SAS No. 70, SAS No. 75, and SSAE No. 4 (AICPA 2000) that relate to opinions on internal controls and agreed-upon procedure engagements.

and inventory management undergo monitoring but very limited public disclosure. It is reasonable to expect that many organizations will have key accounts measured constantly and that new forms of disclosure will emerge to serve the public interest. Litigation avoidance and competitive secrecy are the major reasons that short-term reporting has not yet emerged. Many issues connected to structures of reports, frequency, and target audiences must be resolved to support continuous assurance.

While many of the concepts of continuous auditing/assurance have been in the literature for approximately ten years, the same technologies that create business threats can also be used to facilitate, manage, and assure these business processes. Four such technology-driven issues are considered here: (1) internetworking, (2) digitalization of transactions, (3) intelligent agents, and (4) improved analytics.

*Internetworking* allows for easy derivation of metrics and relationships among organizations in the different levels of the value chain and among the different processes within the organization. This paper focused on relationships that exist within the corporation, and analytics that measure and monitor these relationships. The flow relationships and multiple units of measure exist across entities in both the internal and external value chains.

*Digitalization of transactions* allows for the maintenance of large amounts of data at very small incremental cost and moves the cost equations to the development, not to the operation of the continuous audit system. With the cost of cycles and storage moving asymptotically to zero, new economies of efficient storage and customer analysis are emerging. Customer relationship monitoring and measurement are closely related to continuous assurance and share infrastructure and data.

*Intelligent agents*, acting on the behalf of the client, the stakeholder, or the public, will be used extensively in the evolution of reporting and assurance. Some agents will allow for adaptive and learning procedures performing limited audit/assurance tasks on behalf of the continuous assurance process. Some other agents may perform tasks related to statutory audit requirements such as sampling, substantive testing, and confirmations, while other agents will be selective procedures (e.g., calculating the value of a ratio and its compliance with a bank covenant) targeted at a particular need or stakeholder.

*Improved set of analytics* will enhance the ability to assess relationships in the underlying data.

The integration of the assurance process with corporate data processing will provide a much-improved data stream and a database of relationships where a more extensive and more powerful set of time-series and cross-sectional analytics can be developed and performed. The economies of the new data processing environment will also allow for data-enriched procedures to build models and to analyze the results of comparisons with actuals and models.

## CONCLUSIONS

This chapter aimed to raise a series of conceptual discussions in the area of continuous assurance. At the foundation of this discussion is the basic impact that the current technological environment and the electronization of corporate processes is and will have on the audit/assurance process. Continuous assurance is the congruent electronization of a set of accounting, controlling, monitoring and auditing processes. In evaluating these changes, nine propositions have been put forth and discussed in terms of the impact on the future of audit and assurance services.

- *Proposition 1: The continuous assurance model has many clients.* Traditionally, the audit has been based on the contract between an auditee and the auditor. In the emerging model, various other stakeholders may contract explicitly or implicitly with the auditor.
- *Proposition 2: The continuous assurance model has different independence considerations.* In order to effectively integrate continuous assurance models, the assurer must have access to client systems and become a part of the systems development and implementation process.

- *Proposition 3: The continuous assurance model has a different justification.* Previously the role of the audit was on the moral hazard gap between owners and managers, but in the new assurance model that is emerging, demand may come from many other stakeholders for many different reasons.
- *Proposition 4: The continuous assurance model is an element of the strategic monitoring.* To achieve the goals of the new audit models being adopted by the major firms, an infrastructure that gathers continuous data on strategic and tactical progress throughout the year is critical.
- *Proposition 5: The continuous assurance model will turn the audit process into audit by exception.* Much of the work will be conducted during systems design and implementation with subsequent reliance largely on monitoring agents designed to detect exceptions representing potential system failures or errors.
- *Proposition 6: A new set of analytics guides strategic monitoring.* New analytics will look at a broader range of data relationships, be less restricted to financial measures, and focus more on process equilibrium and continuity.
- *Proposition 7: The continuous assurance model covers a wider set of quantitative and qualitative nonfinancial data.* The wide range of variables noted in Proposition 6 will also support a focus on a broader range of services to be provided by the assurer.
- *Proposition 8: The continuous assurance model has alternate materiality considerations.* A materiality focus on dollar amount of error is no longer applicable to an audit focusing on systems reliability and nonfinancial data. This necessitates a re-thinking of the materiality concept in this new environment.
- *Proposition 9: The continuous assurance opinion has some futurity implied in it.* Continuous audit assurance opinions will go beyond the scope of the traditional audit opinion and report on many other facets of organizational performance. This requires a design that allows reporting on more futuristic information.

These postulates should be implementable by a set of new tools and developments in the area of technology. However, to develop these tools—and even more importantly to determine the preferable set of tools—research and experimentation in continuous assurance is direly needed. Kogan et al. (1999) discussed “Continuous Online Audit,” and proposed research along many different lines of investigation. This chapter expands upon their framework and proposes a diverse range of research topics key to moving toward the goals specified in the nine propositions.

In closing, consideration should also be given to the role continuous assurance plays in the rapidly evolving electronic business environment. The advent of an entirely new commerce environment is forcing new methods of control, privacy, maintenance, and security. This substantially changes the costs/benefits of the automation of the audit/assurance process and provides an abundant domain for continuous assurance services. Critical/high-risk processes that are digital in nature should lead the electronization of the measurement and assurance processes and likely provide the foundational environment for the development of many of the processes and methodologies discussed in this chapter. While electronic business is covered extensively by Gray and Debreceeny in Chapter 10 of this monograph, consideration should be given by the reader as to the interplay between electronic business issues that were raised in that chapter and the continuous audit framework laid out in this chapter.

**TABLE 12-1**  
**Expanded Data Needs**

<b>Need</b>	<b>Quantitative</b>	<b>Qualitative</b>
Environmental scanning	GNP numbers, sectorial numbers, product numbers	News pieces, news pieces about the competition
Competitive analysis	Numbers about the competition's activities	Product quality reviews, new entrants on the value chain, affiliation agreements
Strategic Planning	Forecasts, projections, cost analyses	New technology analysis
Human resources	Costs, salary surveys, employee profile databases, etc.	Web posting by employees, web postings by the public and potential employees
Ecology / conservation	Costs of projects, scientific measures, cost /benefit studies, emission measurements, recycling measures, etc.	Web posting by employees, metrics of corporate responsibility, web postings by the public and potential employees, news pieces on corporate behavior, criticisms on the press, etc.

